CLAIMS

What is claimed is:

1. A window device configured to transmit radiation, the device comprising:

a) a support configured to be subject to a substantial vacuum, and having an opening configured to transmit radiation therethrough;

b) a film, mounted directly on the support across the opening, having a material and a thickness selected to transmit soft x-rays, the film having an evacuated side configured to face the substantial vacuum, and an ambient side configured to face away from the substantial vacuum;

c) an adhesive, directly adhering the film to the support;

d) a coating, covering exposed portions of at least one of the evacuated or ambient sides of the film, and covering a portion of the support surrounding the film; and

e) the film, the adhesive and the coating forming a vacuum tight assembly capable of maintaining the substantial vacuum when one side is subject to the substantial vacuum; and

f) the vacuum tight assembly being capable of withstanding a temperature greater than approximately 250 degrees Celsius.

2. A device in accordance with claim 1, wherein the film is directly adhered to the support without any stress-relief structure.

3. A device in accordance with claim 1, wherein the coating also covers an exposed portion of the adhesive.

4. A device in accordance with claim 1, wherein the coating covers exposed portions of both the evacuated and ambient sides of the film.

5. A device in accordance with claim 1, wherein the adhesive includes an organic material, and wherein the coating includes an inorganic material.

6. A device in accordance with claim 1, wherein the film includes a native oxide covering that is covered by the coating.

7. A device in accordance with claim 1, wherein the support includes a material selected from the group consisting of: monel, kovar, stainless steel and nickel; and wherein the adhesive includes a polyimide that chemically reacts with the material of the support to form covalent bonds.

8. A device in accordance with claim 1, wherein the film and the adhesive include polar materials, and wherein the adhesive has sufficiently low viscosity to fill grain boundary gaps in the film by capillary action to form mechanical bonds.

9. A device in accordance with claim 8, wherein the film includes a beryllium material; and wherein the adhesive includes a polyimide material.

10. A device in accordance with claim 1, wherein the material and the thickness of the film transmits at least 10% of incident radiation of wavelength longer than 18.5 angstroms.

11. A device in accordance with claim 1, wherein the support forms part of a sealed, evacuated chamber; and further comprising an x-ray detector or an x-ray source.

12. A window device configured to transmit radiation, the device comprising:

a) a support configured to be subject to a substantial vacuum, and having an opening configured to transmit radiation therethrough;

b) a film, mounted directly on the support across the opening, including a beryllium material, and having a thickness less than approximately 23 micrometers, the film having an evacuated side configured to face the substantial vacuum, and an ambient side configured to face away from the substantial vacuum;

c) an adhesive, adhering the film to the support, including a polymeric material; and

d) a coating, covering exposed portions of at least one of the evacuated or ambient sides of the film, and covering a portion of the support surrounding the film, the coating including a boron-hydrogen composition; and

e) the film, the adhesive and the coating forming a vacuum tight assembly capable of maintaining the substantial vacuum when one side is subject to the substantial vacuum; and

f) the vacuum tight assembly being capable of withstanding a temperature greater than approximately 250 degrees Celsius.

13. A device in accordance with claim 12, wherein the film is directly adhered to the support without any stress-relief structure.

14. A device in accordance with claim 12, wherein the coating also covers an exposed portion of the adhesive.

15. A device in accordance with claim 12, wherein the coating covers exposed portions of both the evacuated and ambient sides of the film.

16. A device in accordance with claim 12, wherein the film includes a beryllium oxide covering that makes the surface polar and is covered by the coating.

17. A device in accordance with claim 12, wherein the support includes a material selected from the group consisting of: monel, kovar, stainless steel and nickel; and wherein the adhesive chemically reacts with the material of the support to form covalent bonds.

18. A device in accordance with claim 12, wherein the adhesive has sufficiently low viscosity to fill grain boundary gaps in the film by capillary action to form mechanical bonds.

19. A device in accordance with claim 12, wherein the film transmits at least 10% of incident radiation of wavelength longer than 18.5 angstroms.

20. A device in accordance with claim 12, wherein the support forms part of a sealed, evacuated chamber; and further comprising an x-ray detector or an x-ray source.

21. A method for making a radiation window device, comprising the steps of:

a) applying a liquid adhesive to an area of contact between a film and a support, the film being capable of transmitting soft x-rays;

b) disposing the film on the support and across an opening in the support;

c) applying a temperature greater than approximately 250 degrees Celsius to the adhesive, the film and the support to cure the adhesive; and

d) coating an exposed portion of the film with an organic material on at least i) an evacuated side of the film configured to face a substantial vacuum, or ii) an ambient side of the film configured to face away from the substantial vacuum.

22. A method in accordance with claim 21, wherein the step of applying a temperature further includes applying a temperature greater than approximately 450 degrees Celsius.

23. A method in accordance with claim 21, wherein the step of applying a temperature further includes applying a substantial vacuum to the adhesive, the film and the support to cure the adhesive.

24. A method in accordance with claim 21, wherein the step of coating further includes using chemical vapor deposition to apply a boron-hydrogen composition.

25. A method in accordance with claim 23, wherein the step of coating further includes coating exposed portions of the film on both the evacuated and ambient sides of the film.

26. A method for making a radiation window device, comprising the steps of:

a) applying a liquid polymide adhesive to an area of contact between a beryllium film and a support;

b) disposing the film on the support and across an opening in the support;

c) applying a temperature greater than approximately 250 degrees Celsius to the adhesive, the film and the support to cure the adhesive; and

d) coating an exposed portion of the film with a boron-hydrogen composition on at least i) an evacuated side of the film configured to face a substantial vacuum, or ii) an ambient side of the film configured to face away from the substantial vacuum.

27. A method in accordance with claim 26, wherein the step of applying a temperature further includes applying a temperature greater than approximately 450 degrees Celsius.

28. A method in accordance with claim 26, wherein the step of coating further includes using chemical vapor deposition to apply the boron-hydrogen composition.

29. A method in accordance with claim 26, wherein the step of coating further includes coating exposed portions of the film on both the evacuated and ambient sides of the film.